Summary of existing monitoring programs in the National Capital Region

This document summarizes monitoring programs in the National Capital Region. For more information about monitoring in the parks please refer to Park Summaries document sent out for the 1/10/02 SAC meeting. If you need a copy of the document please contact: Marcus Koenen (Marcus_Koenen@nps.gov; 202-342-1443 x216). Last update: 4/30/02.

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Biological Resources

Amphibians

Amphibian Research And Monitoring Initiative (ARMI) – ARMI is being coordinated by Dr. Robin Jung at USGS - Patuxent. ARMI focuses on monitoring population trends and the identification of threats to amphibian populations on federal lands. Malformations are documented with pictures that are sent to NARCAM (North American Center for Amphibian Malformations). Rock Creek Park is currently one of the focus sites along with Acadia, Shenandoah, and two other National Parks. At Rock Creek Park, the work is implemented in cooperation with Partners in Parks.

DOD - USAG Fort Belvoir. Contact: Dorothy Keough (703) 806-0049; keoughd@belvoir.army.mil. Amphibian and reptile surveys include: baseline inventories performed by Dr. Carl Ernst (George Mason University) from 1987 through 1994; in-house sampling by Army biologists from 1988 to 1994 (neither of these allow for trend analyses); field surveys by Dr. Joe Mitchell (University of Richmond) 1995 to 1996. Presently, there is no monitoring program. Development and implementation of a monitoring program is being discussed with Dr. Joe Mitchell.

DOD – Quantico Marine Base: Contact Bruce Frizzel (703-784-4030; frizzellb@nt.quantico.usmc.mil). Surveys have been conducted on amphibians but there is no long-term monitoring in place.

Fish and Wildlife Service – National Wildlife Refuges – In 2000, the Service launched a nationwide survey of malformed amphibians on wildlife refuges (http://contaminants.fws.gov/Issues/Amphibians.cfm). If malformed amphibians are found, the Service will then seek to identify the causes and provide concrete management guidelines to correct the problem.

Fish and Wildlife Service – Patuxent NWR (Contact: Brad Knudsen - Refuge Manager: 301-497-5580; Holliday Obrecht – Biologist - Holliday_Obrecht@fws.gov). Participates in NAAMP (see below). The refuge also surveys vernal pools for wood frogs.

Fish and Wildlife Service - Potomac River National Wildlife Refuge Complex (Mason Neck, Occoquan Bay, Featherstone). Contact Joe Witt (Biologist; 703-490-4979; joe_witt@fws.gov). Conducts general frog surveys sponsored by the region 4x per year (set protocols are in place; work is conducted by contractors Jennifer Lee and Carol Pollio; the call counts feed into NAAMP [see below]); -amphibian egg mass survey conducted by TJ High School; deformed frog surveys (as part of USFWS Chesapeake Field Program).

Frogwatch – Sponsoring agency: USGS – Patuxent coordinates this volunteer effort to monitor population trends of frogs. Data is entered online and results can be viewed: http://www.mp2-pwrc.usgs.gov/frogwatch. Data has been collected locally at Riverbend

Park, Fairfax County, and Holmes Run II Stream Valley Park. In Maryland at Cabin John Creek, Montgomery County; Flinstone, Allegany Co; >5 sites in Anne Arundel County; Greenbelt, Prince Georges County; 2 sites in Washington Co; there are no sites in Frederick County. Only 1999 data is available online.

North American Amphibian Monitoring Program (NAAMP) – Sponsoring agency: USGS. NAAMP is coordinated centrally by Patuxent but implemented locally. Local contacts include: Mary-Keith Garret of VDGIF in VA; Wayne Hildebrand (301-898-7025) in Maryland; and Tom Pauley in WV. Linda Weir, USGS, is the National Coordinator. The NAAMP consists of roadside transects approximately 15 miles long with 10 stops. It is conducted 3x a season. Counts are made of all calling amphibians. The routes are randomly generated through wetland habitats. A few were selected for specific sites (e.g.: Blackwater NWR). There is one near Catoctin Mountain Park that starts at the ranger station. Goal is to track amphibian populations much like the Breeding Bird Survey. Data goes into online database managed by Sam Droege, USGS. The standard protocol is being implemented by the USFWS on National Wildlife Refuges.

Birds

Atlantic Coast Joint Venture (ACJV). Contact for the ACJV is Craig Watson (843-727-4707, x16; craig_watson@fws.gov). There are 7 active Joint Ventures in North America (12 are planned coast to coast). At first their focus was on waterbirds but Joint Ventures are now evolving to implement the North American Bird Conservation Initiative. Each joint venture has a management board (policy decisions) and technical committee (review proposals). The National Capital Region overlaps with the Atlantic Coast Joint Venture. They have funded one restoration project in the region and may be interested in funding additional restoration/monitoring programs through the North American Wetland Conservation Act (NAWCA). Any project having to do with wetlands and birds can apply for funding. Simple habitat restoration can work. A Mid-Atlantic Joint Venture is in the planning phase. Coordinators include: Bryan Watts (College of William and Mary), Larry Niles (New Jersey), and Ed Temple (Ducks Unlimited). Virginia contact is: David Norris. Maryland contact is: Larry Heinsman.

Breeding Bird Survey (BBS) – Within the parks, the BBS is only conducted at Prince William Forest Park. It was initiated in 1991 and has been conducted sporadically by volunteers. Data is available through USGS Patuxent (http://www.pwrc.usgs.gov/).

Christmas Bird Counts (CBC) – There are several CBCs in the region. This is part of an annual winter bird survey coordinated by the Audubon Society since 1901. Several counts cover the parks including Fort Belvoir (covers parts of GWMP), Frederick (covers parts of CATO), and Bull Run (covers parts of MANA), and DC (covers parts of ROCR). Data for the count circles is available online at Cornell University (www.birdsource.org). Park specific data has been provided to the NPS I & M Program for some years.

DC Audubon Mid-Winter Count. Contact Mike Milton (mikemilton@attglobal.net). A mid-winter count has been implemented by the DC Audubon Society since 1998. This count covers the entire length of the C & O Canal. Data is summarized each year and has been submitted to the NPS I & M Program but that data has not yet been analyzed.

DOD – USAG Fort Belvoir: Contact: Dorothy Keough (703) 806-0049; keoughd@belvoir.army.mil. Land bird survey (breeding bird, migratory bird and wintering bird surveys), waterfowl and shorebird surveys have been done since 1998. The protocols for these surveys were developed in coordination with Dr. Richard Fischer of U.S. Army Research and Development Center (ERDC, formerly Waterways Experiment Station). (Turkey surveys (winter and spring) have been done since 2000. Chimney swift survey began in 2001. Bluebird nest box production surveys have been done since 1996. In 2001, the bluebird monitoring was turned over to the Northern Virginia Bluebird Society. MAPS monitoring has been done by IPBS since 1995. Christmas Bird Count has been done since the 1940's; currently it is done by the Fairfax Audubon Society.

DOD – Quantico Marine Base: Contact Bruce Frizzel (703-784-4030; frizzellb@nt.quantico.usmc.mil). The Marine Base conducts Monitoring Avian Productivity Stations (MAPS – see below) and annual turkey gobbler counts. Occasional research projects have been conducted on Wood Thrushes and other songbirds.

Fish and Wildlife Service – Patuxent NWR. The refuge manages about 12,800 acres and lies adjacent to the Baltimore parkway. A variety of surveys are conducted at the refuge (Contact: Brad Knudsen - Refuge Manager: 301-497-5580; Holliday Obrecht – Biologist - mailto:Holliday_Obrecht@fws.gov).

- Waterbird surveys to track populations since 1988 (FWS surveys along Potomac also). Also tracks waterfowl harvest.
- Woodcock surveys are conducted during their spring migration period and summer breeding period.
- Whip-poor-will counts are conducted at the end of May.
- Turkey call surveys.
- CBC and BBS surveys are conducted in cooperation with volunteers. See CBC and BBS above for details.

In addition to the monitoring programs listed above, the refuge is participating in a regional grassland breeding bird research project designed to evaluate a variety of management options. The effort is lead by Zone Biologist Hal Laskowski who is based at Prime Hook Delaware (302-684-4028). The Principle Investigator is Dr. Michael Runge at Patuxent Wildlife Research Cntr. (301-497-5748). The region 5 coordinator is Laurie Mitchell (coordinator; 757-986-3705).

Fish and Wildlife Service - Potomac River National Wildlife Refuge Complex - Mason Neck (MN), Occoquan Bay (OB), Featherstone (FS). Contact Joe Witt (Biologist; 703-490-4979; joe_witt@fws.gov). The 3 refuges are managed together; a

fourth may be added in the near future. Important resources include grassland habitat, marsh, and shoreline. There are a variety of inventory and monitoring programs coordinated at the refuges. Most are conducted at least in part by volunteers.

- Songbirds surveys (conducted by volunteer: Jim Wagoner; no standard protocol)
- Bluebirds (nest box volunteer program) at OB and MN
- CBC - the refuge is part of Fort Belvoir CBC (volunteers)
- NV Bird Survey (volunteer effort: Carolyn Williams and Fairfax Audubon; see below for details)
- Bald Eagle Surveys (spring, fall, and winter shoreline surveys--done by Joe with volunteers); roosting survey--year round by volunteers)
- Upland Bird Point Count (winter bird point count surveys, spring bird point count surveys, evening bird point count surveys, territorial mapping surveys (intensive point count grid))
- Monitoring Avian Productivity and Survivorship (MAPS) – the refuge participates in the Ft. Belvoir study (See DOD above) with 2 sites at MN
- Winter Heron Nest Census/Productivity Survey
- Spring migrant bird banding (data feeds into Patuxent Bird Banding Lab data)
- Osprey surveys in spring
- Duck surveys and banding

Monitoring Avian Productivity and Survivorship (MAPS)– the nationwide constant effort mist-netting projects are designed to look at long-term trends of breeding bird populations. They are coordinated by the Institute for Bird Population Studies (IBPS; David Desante, Point Reyes, CA). Local MAPS are organized by Fort Belvoir (see DOD above), Quantico Marine Base, Jug Bay, Adventure Banding Station (run by Jenna Radco in Potomac Maryland Gradko@aspensys.com since 1999) and Shenandoah National Park. IBPS gathers and manages the data.

Mid-Winter Waterfowl Survey: USFWS does a mid-winter waterfowl inventory along lower Potomac. They only go up a certain distance and do not cover DC region. Contact Jim Goldsberry of USFWS for information (James_R_Goldsberry@fws.gov, phone 301-497-5880).

Migration Banding Stations – Margaret and Donald Stokes have run a banding station during the migration period in Northern Virginia for about 20 years. Trend data has not been analyzed. An additional migration banding station is run out of Jug Bay in Anne Arundel County; a fall migration banding station is run out of Patuxent Wildlife Research Center.

Migration Counts – Annual migration counts are conducted on a county basis by volunteers. Jim Stasz is the volunteer coordinator and collects datasheets from the national effort (Jlstasz@aol.com). Data is available for some years covering Rock Creek Park and Prince William Forest Park. Most data, however, is not easily retrievable.

NPS – Bird Inventory – The National Capital Region initiated a volunteer bird inventory in 2000 as part of the Inventory and Monitoring Program. Protocols were developed and are posted online: http://www.nps.gov/cue/bird.html. Volunteers are conducting year-round inventories at six parks including Antietam National Battlefield, Catoctin Mountain Park, Harpers Ferry National Historical Park, Manassas National Battlefield, Prince William Forest Park, and Wolf Trap Farm Park.

Northern Virginia Bird Survey covers several designated Ecological Management Zones by the Fairfax County Comprehensive Plan including: Manassas National Battlefield, Woodbridge NWF (Formerly Harry Diamond Labs.), Mason Neck NWR and State Park, Ellanor C. Lawrence Park, Oak Marr Park, Riverbend Park, Fraser Preserve (TNC), Huntley Meadows, Scott's Run Nature Preserve, Difficult Run, Hemlock Overlook and Bull Run Marina, Regional Park at Clarks' Run, and Bull Neck Run. The project was designed like DC Birdscape. Randomly selected points were established at each of the survey sites and Fairfax Audubon Society volunteers have conducted point counts since 1995. Key contact is Carolyn Williams (703-256-6895). In 2001, graduate student Tom Fagan at George Mason University (tfagan@co.loudoun.va.us) started to analyze the population trend data.

Smithsonian Environmental Research Center (SERC) – Peter Marra (443-482-2224; marra@serc.si.gov) is coordinating Neighborhood Nestwatch program in this region. This is a habitat suitability study but may be ongoing and long term. It focuses on residential areas in the DC Area. National Parks are not included.

EPA – Mid-Atlantic Integrated Assessment (MAIA) – MAIA developed a fact sheet "Birds Indicate Ecological Conditions of the Mid-Atlantic Highlands" which discussed using birds as indicators. The work was based on extensive field sampling in the mid 1990's. This project was used to identify indicator species of certain habitats in the highlands of Maryland and West Virginia. There is an additional attempt to identify indicator species for the lowlands but the work has not been completed.

Partners in Flight – The national PIF has developed Bird Conservation Plans with management and conservation recommendations. Ken Rosenberg is the NE Regional Coordinator (607-254-2412). Specific Bird Research ideas are now listed on the PIF web database (http://www.partnersinflight.org/) Recommendations for the National Capital Region include research on Cerulean Warblers and grassland species.

In addition, PIF has developed regional bird conservation plans. The National Capital Region is covered by two plans:

Mid-Atlantic Piedmont Bird Conservation Plan: Species of Concern are listed for the region (Author: Richard Kearney, National Audubon Society – Important Bird Area Coordinator - Kearney.Richard@epamail.epa.gov). Conservation recommendations include protection of grasslands >50 hectares for Henslow and Grasshopper Sparrows. In addition, forest blocks that are large enough to protect Cerulean and Kentucky Warblers should be identified.

Mid-Atlantic Coastal Bird Conservation Plan: Species of Concern are listed for the region (Author: Dr. Bryan Watts, College of William and Mary). Conservation of Forest Bird Species are a high priority especially Wood Thrush, Cerulean Warbler, and Prothonotary Warbler. Also, protection of grasslands >50 hectares for Henslow Sparrows.

For more information: http://www.partnersinflight.org/pifbcps.htm

VA Department of Game and Inland Fisheries. The state is monitoring Bald Eagles during the nesting stage. The work is coordinated with The College of William and Mary. The survey covers the eastern 1/3 of Virginia. Contact: Jeff Cooper (540-899-4169). In addition, VDGIF is working with NPS (Shenandoah, Harpers Ferry), Dominion Power, and William and Mary to release and monitor Peregrine Falcons. Several falcons were released at Harpers Ferry NHP in 2001.

Fish (See also "Water Quality" for fish monitoring)

Interstate Commission for the Potomac River Basin (ICPRB) - Jim Cummins is monitoring fish along the Potomac River. He is primarily looking at Shad survivorship. Shad and Herring restoration is ongoing at Anacostia and Rock Creek. This is being monitored in two ways: first monitor natural reproduction in mid-July. Monitoring transects are established from Chain Bridge to Wilson Bridge using a push net on a Jon-boat. In Spring, they monitor for adults at Great Falls and Mather Gorge using gill nets. Cummins identified monitoring needs in the region's tributaries such as Rock Creek, Watts Branch, Greenbelt, and Kenilworth.

In the Bay Journal (9/01), Cummins reported a very strong run of American Shad in the Potomac during 2001. Shad return to their native streams after 4 years old to spawn. Shad recovery has emphasized building fish ladders so that fish can return to native areas and by stocking them. Improving water quality and restricting fishing pressure were also part of the issue. Since 1986 nearly 320 million fry have been released. About 922 miles of historic spawning habitat has been opened with the fish ladders. Poaching does not seem to be a big problem except in some locations.

Maryland DNR - Biological Stream Survey Results (MBSS) – Maryland MBSS came out with a State of the Stream Report 1995 – 1997 that includes statewide sampling in streams. The probabilistic survey design was established to evaluate water quality. In addition, the MBSS sampled aquatic animals (fish populations, benthic macroinvertebrates, amphibians and reptiles, freshwater mussels), Aquatic Vegetation, physical habitat, and water chemistry at each site. They developed Indices of Biological Integrity for fish and benthic macro-invertebrates (Fish IBI, Benthic IBI, Hilsenhoff Biotic Index) to tell us the overall ecological health of the stream system. MBSS also looked at acidification and physical habitats, nutrients, watershed land use. Some of the sample sites may include NPS lands. Given the study design, results can be extrapolated to cover the parks. Contact is Paul Kazyak (410-260-8607). Other potential contacts include Bob Lundsford (410-260-8321). His focus is game fisheries with DNR.

DC – Dept. of Environmental Quality – The Dept. analyzes fish tissue for contaminants every 4 years. Contact is Jim Collier (202-535-1656).

Fish and Wildlife Service – Patuxent NWR. The refuge collects creel data on fish taken out of impoundments. Contact: Brad Knudsen - Refuge Manager (301-497-5580); Holliday Obrecht – Biologist (mailto:Holliday_Obrecht@fws.gov).

Invertebrates (See also "Water Quality" for aquatic invertebrate monitoring)

DOD - USAG Fort Belvoir. Contact: Dorothy Keough (703) 806-0049; keoughd@belvoir.army.mil. Cankerworm surveys. Gypsy moth surveys. Mosquito surveys.

Fish and Wildlife Service – Patuxent NWR. The refuge participates in volunteer butterfly counts. See NABA below. Contact: Brad Knudsen - Refuge Manager (301-497-5580) and Holliday Obrecht – Biologist (mailto:Holliday_Obrecht@fws.gov).

Fish and Wildlife Service - Potomac River National Wildlife Refuge Complex (Mason Neck, Occoquan Bay, Featherstone). Contact Joe Witt (Biologist; 703-490-4979; joe_witt@fws.gov). The refuge participates in volunteer butterfly counts. See NABA below.

Gypsy Moth Monitoring (National Park Service – National Capital Region) - Gypsy Moths are monitored by NPS at all parks except Antietam which has no sizable forest. There are two main ways to monitor. 1. Parks are encouraged to keep their eyes open and implement egg mass walking surveys for any Gypsy Moth infestation. This would happen in late summer/early fall. 2. USDA FS – Rod Whiteman, (304-285-1555) conducts aerial surveys to look for evidence of gypsy moth defoliation and will record observations on maps during flights in early summer. Areas of infestation are roughly sketched out on maps. Heavily infested areas are surveyed on foot along transects and randomly placed circular plots. If heavy infestations occur, proposals must be written to implement spraying activities. This effort is coordinated by the National Capital Region IPM program. In addition, Forest Service surveys for other pests including Hemlock Wooly Adelgid, Eastern Tent Caterpillar, Canker Worms. This work is also coordinated with the regional IPM Coordinator (Contact is Jil Swearingen - 202-342-1443 x218; jil_swearingen@nps.gov).

Mosquito Monitoring (National Park Service – National Capital Region) – In 2001, a cooperative monitoring program was implement to identify the threat of West Nile Virus. Cooperating agencies included: NPS, DOD, USDA, DC Dept. of Health, and County agencies. In 2001, NPS hired 3 biotechnicians to survey in all parks of NCR. The monitoring may continue in 2002.

North American Butterfly Association (NABA) - NABA coordinates a number of activities including the 4th of July Butterfly Count. This volunteer effort is coordinated

locally through the **Washington Area Butterfly Club** (http://users.sitestar.net/butterfly). There are about 10 counts in the DC/Northern Virginia region. The counts are styled after the Christmas Bird Count 15 mile radius counts and often use the same count circle. Counts occur in July when the greatest diversity of butterflies is present including Spring and Fall species. A number of our parks are covered including Manassas and Great Falls. The DC area contact is Pat Durkin (202-483-7965, plusultra@aol.com). NABA has 20 years of data and maintains the data on their web page (www.naba.org). They are using the count data to compile a butterfly Atlas of Virginia by County.

Mammals

Ann Arundel County – Conducts Infrared Helicopter Counts for white-tailed deer through Howard County. Contact Phil Normen at Howard County: (410) 313-1675.

DOD – USAG Fort Belvoir: Contact: Dorothy Keough (703) 806-0049; keoughd@belvoir.army.mil. For deer we also collect harvest data (annually) and have the DGIF perform herd health checks every 3 – 5 years. Since 1999 have performed raccoon trapping as part of Fairfax County's experimental raccoon rabies vaccination program. From 1987 through early 1994, Dr. Carl Ernst (George Mason University) inventoried mammals (survey does not allow for trend analyses). inventoried mammals. Deer are only species with long-term monitoring (spotlight survey and harvest data collection since 1988). They estimate about 60-80 deer per square mile despite the bow hunting that removes about 20-25% of the doe each season. In 2001 began work on developing a protocol for bat inventories and monitoring. Working with Dr. Chester Martin of U.S. Army Engineer Research and Development Center (ERDC, formerly Waterways Experiment Station) to develop survey protocol.

DOD – Quantico Marine Base: Contact Bruce Frizzel (703-784-4030; frizzellb@nt.quantico.usmc.mil) or Wildlife Biologist Tim Stamps (703-784-5383). Hunts are conducted on the base. Biologists conduct spotlight counts coordinated with VDGIF.

Fish and Wildlife Service – Patuxent NWR. The Refuge (Contact: Brad Knudsen - Refuge Manager: 301-497-5580; Holliday Obrecht – Biologist - Holliday_Obrecht@fws.gov) conducts a variety of surveys:

Mammal Surveys

- Deer surveys. Sport hunting counts. Dusk survey, nightlight count, deer fawn survey. Carrying capacity is estimated at about 6-8 deer per 20 acres. Sport hunting program keeps deer at capacity. Also conduct surgical harvests in sensitive areas. The refuge collects harvest data, including dressed weight, age, sex, and location.
- Squirrel harvests are recorded.

Fish and Wildlife Service - Potomac River National Wildlife Refuge Complex (Mason Neck, Occoquan Bay, Featherstone). Contact Joe Witt (Biologist; 703-490-4979; joe_witt@fws.gov). The 3 refuges are managed together; a fourth may be added in the near future. Important resources include grassland habitat, marsh, and shoreline. There are a variety of inventory and monitoring programs coordinated at the refuges. Most are conducted at least in part by volunteers.

Mammals:
- Small mammal surveys (conducted by Northern Virginia Community College professor Larry Underwood)
- Deer spotlight surveys conducted annually. The refuge has 10 years of data; density at OB is 99 deer/sq mile; hunting is limited to 4 days a year at Mason Neck
- A study on deer reproduction is underway through Conservation Research Center in Front Royal.

Howard County – Conducts Infrared Helicopter Counts for deer. Contact Phil Normen (410) 313-1675.

MD DNR – Deer are tracked statewide through hunting permits and number of deer shot in the region. Contact is Jim McCann – Zoologist (410-827-8612; Jmccann@dnr.state.md.us).

Virginia Dept. of Game and Inland Fisheries – Occasionally conducts coordinated spotlight counts with county agencies and on state lands. See DOD Fort Belvoir and DOD - Quantico above

Reptiles

DOD – USAG Fort Belvoir. Contact: Dorothy Keough (703) 806-0049; keoughd@belvoir.army.mil. Amphibian and reptile surveys include: baseline inventories performed by Dr. Carl Ernst (George Mason University) from 1987 through 1994; in-house sampling by Army biologists from 1988 to 1994 (neither of these allow for trend analyses); field surveys by Dr. Joe Mitchell (University of Richmond) 1995 to 1996. Presently, there is no monitoring program. Development and implementation of a monitoring program is being discussed with Dr. Joe Mitchell.

T & E Species (& Species of Concern)

DOD - USAG Fort Belvoir. Contact: Dorothy Keough (703) 806-0049; keoughd@belvoir.army.mil. Virginia Department of Conservation and Recreation (DCR) Division of Natural Heritage (DNH) performed an installation-wide rare species (plant and animal) survey in 1996 – 1997Fort Belvoir has nest production data for the installation's bald eagle nest since it was established in 1991, and has been performing

year-round shoreline monitoring and nest surveys since 2000. An installation-wide wood turtle survey was initiated in 2002, by Dr. Joe Mitchell, University of Richmond.

DOD - Quantico Marine Base – Survey for Small-whorled Pogonia using Heritage Methodology. Contact Wildlife Biologist Tim Stamps (703-784-5383). About 12 clusters are known.

MD Department of Natural Resources - Wildlife and Heritage Division – The Heritage program ranks species and plant communities. Contact Jim McCann, MD DNE, Wildlife and Heritage State Zoologist (410-827-8612; Jmccann@dnr.state.md.us). For plants contact Richard Wiegand, Ecologist (301-845-8997). Heritage focuses on rare species (state listed species and G1-G3 ranks),rare communities, and tries to identify lands for acquisition either for MD or for TNC. Some rare species surveys are done annually, some are done less frequently, depending on need. The department covers public lands in Maryland but also have some contracts with private lands. Examples of monitoring projects include tiger beetles, mussels, state rare birds (Bald Eagle, colonial waterbirds, small mammal such as the Smoky and Pygmy shrews, and Great Blue Heron Colonies). Monitoring data typically includes presence absence information and some measure of relative abundance.

VA Heritage has surveyed rare species throughout the NCR parks and will likely continue when funds are available. Monitoring data typically includes presence absence information and some measure of relative abundance. Contacts: Chris Hobson (bats etc., 804-786-7951); Steve Roble (insects, 804-786-8633); Ann Chazal (mammal).

Vegetation

Arlington County: The county is contemplating an exotic plant management program as of summer 2001. Contact: NA

DOD - USAG Fort Belvoir. Contact: Dorothy Keough (703) 806-0049; keoughd@belvoir.army.mil. In 1999, Department of Natural Heritage performed installation-wide mapping of plant community types, using a protocol based upon National Vegetation Classification System. Dr. Elizabeth Wells of George Washington University performed a plant inventory 1998 – 1999. An installation-wide wetland survey was completed by Paciulli, Simmons and Associates, Ltd. in 1999.

DOD – Quantico Marine Base: Contact Bruce Frizzel (703-784-4030; frizzellb@nt.quantico.usmc.mil). The base is monitoring small-whorled pogonia. About 12 clusters are known.

Fish and Wildlife Service – Patuxent NWR. (Contact: Brad Knudsen - Refuge Manager: 301-497-5580; Holliday Obrecht – Biologist - Holliday_Obrecht@fws.gov). The refuge collects a variety of vegetation data including:

- Vegetation is monitored to measure effects of drawdowns in ponds
- Hyperspectral Data has been collected (1-m data) to develop detailed vegetation maps
- Have detailed GIS overlay showing roads and open water
- Rare and Endangered plants being monitored annually.
- Monitor scrub/shrub habitat along powerline right of ways. Species diversity of vegetation is measured along transects every 7 years.

Fish and Wildlife Service - Potomac River National Wildlife Refuge Complex (Mason Neck, Occoquan Bay, Featherstone). Contact Joe Witt (Biologist; 703-490-4979; joe_witt@fws.gov). The 3 refuges are managed together; a fourth may be added in the near future. Important resources include grassland habitat, marsh, and shoreline. There are a variety of inventory and monitoring programs coordinated at the refuges. Most are conducted at least in part by volunteers. A regional grassland bird research project is evaluating various management regimes on vegetation and bird populations. Management regimes include mowing and prescribed burns at varying time intervals. There are 18 points at Occoquan and 28 at Mason Neck where change in percent composition is measured annually.

Maryland Native Plant Society - http://www.geocities.com/rainforest/vines/2996. The society is conducting inventories of native plants at Fort Circle Parks in DC. Data is being submitted to NACE. The Society is also volunteering on exotic plant removal at Rock Creek and Greenbelt Park.

MD TNC - Most monitoring efforts on TNC lands are contracted through MD Heritage. TNC, however, does monitor about 5-6 Harperella sites near Sideling Hill Creek in Alleghany County. The creek flows into the Potomac.

NPS Exotic Plant Management Team (EPMT) - The team was established in 2000 as part of the NPS Natural Resource Challenge. It was established to assist parks in identifying and controlling invasive exotic species. The team is now active at all parks in the region. Their survey/monitoring protocols are being standardized nationwide. At present, the focus of the team is: 1. Survey/Inventory, 2. Treatment, and 3. Monitoring. Each park is divided into sites (management units) by the park. Each site is sub-divided into "infestations". Definition of an "infestation" is subjective at the moment but may include single or multiple species. Infestations are inventoried, mapped, and outlined. The team estimates the area and percent cover. In addition, the team notes open water sources. Ideally the areas are surveyed again at a different time of year to see if other species may be present. Also, permanent photo points are established. After the initial survey, the area is treated. Surveys are repeated as needed depending on the species treated. There is no strict protocol for monitoring although if an infestation has been removed and does not reappear for 5 years, the survey will be cut down to once every 5 years. Quarterly reports are completed. A national database is being developed to store treatment and monitoring data.

USDA Forest Service – USDA coordinates two main I & M programs.

1. Inventory and Analysis (FIA) – The FS is implementing the FIA program for each region (the NE covers MD and WV; SE covers VA). In the past, complete inventories were conducted approximately once every 10 years in each state; mid-cycle or special inventories were conducted as special issues and needs warranted. Such resource information has been collected for all lands, public and private for more than 30 years. The project provides landscape level information about forestry resources. The data is constantly used by a wide variety of research groups, natural resource agencies, conservation associations, state and regional economic development groups, individual landowners, the forest products industry, and others who are interested in the extent, condition, and use of forest resources.

Recently, the data collection protocols have changed. Now, between 10 and 20 percent of all Forest Inventory and Analysis sample plots will be measured each year in every state. A compilation of all the data collected will be made available annually to the public. Every five years a report will be prepared, published, and made available to the public (with the cooperation of the State foresters) detailing the results of the previous inventories, and an analysis of the forest health conditions and trends over the previous two decades. National standards and definitions will be implemented to ensure uniform and consistent data collection by the various Forest Inventory and Analysis Units located throughout the country.

Inventories of forest resources including estimates of trends in forest area, species composition, growth, mortality, and harvesting levels. Surveys of the patterns, trends, and numbers of private forest-land owners. Studies of timber utilization and processing to determine the amount of timber that is removed from the forest and converted into wood products. Measurement of a variety of ecological parameters including wildlife habitat, forest biomass, soil conditions, forest fragmentation, and damage due to insects, disease, and other factors. Research in sampling designs, remote sensing techniques, Global Positioning Systems (GPS), and analytical techniques related to inventorying and monitoring forested ecosystems.

Also, tree crown conditions, lichen community composition, understory vegetation, down woody debris, and soil attributes are collected. Soil samples are sent to a laboratory for chemical analysis. Finally, an associated sample scheme exists to detect cases of ozone damage occurring to adjacent forest vegetation. Detailed sampling manuals are available online (fia.fs.fed.us – link to library). Sup-plots are set up on some private and some federal lands. The data collection includes full floristic survey on sub-plots (1 ha plots). All plots are permanent. Location information of all plots is exempt from FOIA and not available to the public. Contact Chip Scott (Program Manager in Philadelphia; 610-557-4020).

2. Forest Service: The Forest Health Monitoring Program (FHM)
(http://www.na.fs.fed.us/spfo/fhm/) FHM is a national program designed to determine the status, changes, and trends in indicators of forest condition on an annual basis. This is

part of the FIA program. The FHM program uses data from ground plots and surveys, aerial surveys, and other biotic and abiotic data sources and develops analytical approaches to address forest health issues that affect the sustainability of forest ecosystems. It has the lead for monitoring forests in the mid-Atlantic. An assessment of the forests is currently underway. A process has been identified to develop and evaluate the performance of indicators used in FHM. Included in this process are the following steps:

1. Identify relevant environmental or societal values of concern,
2. Formulate key questions relating to those values,
3. Review the scientific literature and available databases,
4. Note gaps in the FHM conceptual model and select new candidate indicators,
5. Test indicators in pilot and demonstration studies,
6. Formulate plot level indices,
7. Review indicators, by internal FHM partners, and
8. Review indicators, by non-FHM scientists.

Part of the internal FHM review process is the evaluation of indicators relative to defined indicator development criteria. These six criteria increase the scientific objectivity, consistency, and depth of indicator evaluations in FHM. A variety of data sources (such as quality assurance, field monitoring activities, pilot studies, research studies), are used to evaluate how well the indicators are meeting the criteria. More information on indicators can be found at: http://willow.ncfes.umn.edu/fhm_fact/list.htm.

Right now focus of FHM are measuring plots across the states to evaluate forest type and condition. Measurements on the detection plots involve seven major groups or indicators. Mensuration (including tree growth, mortality, regeneration), crown condition, and tree damage have been measured since the beginning of the program. Ozone bioindicator plants were instituted in 1994 and are a measure of ozone-sensitive plants' response to ambient ozone (http://www.na.fs.fed.us/spfo/fhm/ozonetrng/biozone.htm). These plants are evaluated at or near the FHM detection plot. Vegetation diversity, lichen communities (populations), and photosynthetically active radiation (PAR) were implemented in 1994 for the first time on a 1/4 subset of the detection plots. Due to budget constraints, this was only continued in Virginia in 1995. Other measurement groups (indicators) being evaluated include soils, dendrochronology, wildlife habitat, and foliar conditions. Pest monitoring includes Gypsy Moth, Bark Beetles, Hemlock Wooly Adelgid, Fall Cankerworms, Walkingsticks, etc.

Weeds Survey of Federal Lands – NPS is a partner. This one time survey was established to determine weed infestations on DOI lands. The survey was simply a questionnaire asking about the impacts of exotics on federal lands. Gary Johnston (NPS) worked on this project. There have been several products based in part on this work: “Invasive Plants”, “National Strategy for Invasive Plant Management”. The results are not site specific.

Abiological Resources

Air Quality

EPA – MAIA web page has an analysis about regional Air quality.

Fairfax County – The county monitors ambient air pollutant levels to indicate compliance or non-compliance with federal standards. They monitor EPA Criteria Pollutants including Ozone (O3), Carbon Monoxide, Nitrogen Dioxide, Sulfur Dioxide, Lead, and Particular Matter. Also monitor total suspended particulates (TSP), Nitric Oxide, and meteorological components such as wind speed, wind direction, temperature, and rainfall. There are several air quality monitoring stations in the area. Data is available from 1973 to the present. See Air Quality/Appendix C for locations (Filed under D:/Work Monitoring – Air). The 1998 Annual Report is also available. History: Air pollution in DC Metro area has been on the decline during last 10 years but will likely fall short of a 2005 cleanup deadline. The shortage is attributed to the more than expected number of SUVs on the road.

Metropolitan Washington Council of Governments (www.mwcog.org)– is the entity certified by the mayor of the District of Columbia and the governors of Maryland and Virginia to prepare an air quality plan for the DC-MD-VA Metropolitan Statistical Area under Section 174 of the federal Clean Air Act Amendments of 1990. MWAQC members are elected officials of COG member jurisdictions plus members from Charles, Calvert, and Stafford counties; the air management and transportation directors of the District of Columbia, Maryland, and Virginia; members of the Maryland and Virginia General Assemblies; and the chair of the Transportation Planning Board. In executing its responsibilities, MWAQC coordinates air quality planning activities among COG, other external committees, and the Transportation Planning Board; reviews policies; resolves policy differences; and adopts an air quality plan for transmittal to the District of Columbia, Maryland, and Virginia. MWAQC subcommittees include the Executive Committee, the Technical Advisory Committee (TAC), and the Air Quality Public Advisory Committee (AQPAC).

Report on Air Quality Trends in the Washington Metro Area. The data are collected by agencies in Virginia, Maryland, DC, and by health Dept. in Alexandria and Fairfax County. "Air Quality Trends in the Washington Metropolitan Region: 1985-1996" states that levels for 6 of 7 pollutants for which EPA has set standards. Only Ground level Ozone is increasing. There is a State Implementation Plan (SIP) which discusses that even with local reductions in Ozone, the area may still be above standards because of upwind pollution. Under the Clean Air Act, UPA can compel upwind area to take action to reduce the transported air. EPA has issued a NOX SIP Call to compel action from states upwind of DC and other non-attainment areas. Those require reduction beginning in 2003 with effects noticeable by 2005. Currently, the EPA action is being challenged in court by states and industries.

National Park Service - Air Resource Division (ARD). ARD has developed an Air Resources Inventory for the National Capital Region. The inventoy includes in-park and out-of-park resources and reports confidence in the baseline values. Wet Deposition: None of the NPS units in the National Capital Network have a National Atmospheric Deposition Program/National Trends Network (NADP/NTN) wet deposition monitor on-site, but all units have a monitor within 100 km (60 miles). NADP/NTN collects data on both pollutant deposition (in kilograms per hectare per year) and pollutant concentration (in microequivalents per liter). Dry Deposition: None of the units in the National Capital Network have a Clean Air Status and Trends Network (CASTNet) dry deposition monitor on-site, but all units have a monitor within 100 km. CASTNet uses different monitoring and reporting techniques than NADP/NTN, so the dry deposition amounts are reported here as nitrogen and sulfur, rather than nitrate, ammonium, and sulfate. Surface Water Chemistry: The Water Resources Division's (WRD) *Baseline Water Quality Data Inventory and Analysis* reports were reviewed for all of the NPS units in the National Capital Network. Acid-sensitive surface waters typically have a pH below 6.0 and an acid neutralizing capacity (ANC) below 100 microequivalents per liter (μeq/l). Do we have any meeting these criteria? Visibility: All parks in the National Capital Region are within 100 miles of an Interagency Monitoring of Protected Visual Environments (IMPROVE) station. Ozone: None of the units in the National Capital Network have an ozone monitor on-site, but all units have a monitor within 25 km (15 miles) of some portion of the park. Based solely on spatial distribution of ozone monitors, it appears the portion of the Chesapeake and Ohio Canal NHP between Hagerstown and Cumberland, Maryland, may not be well-represented by existing monitors. In addition, it is not clear if monitors in Frederick and Hagerstown, Maryland, adequately represent ozone conditions in Catoctin Mountain Park. Vegetation: For vegetation, the focus is on ozone sensitivity because 1) ozone is a regional pollutant and is, therefore, more likely to affect park resources than either sulfur dioxide or nitrogen oxide which quickly convert to other compounds, and 2) the literature on ozone sensitivity is more recent and more reliable than that for other pollutants. Species sensitive to ozone damage are listed in the report for each park. Contact: Tonnie Maneiro (ARD; 716-461-2106).

National Park Service – National Capital Region – Doug Curtis (NPS – NCR) monitors air quality on top of Park Police Building on East Potomac Island. It only measures particulates.

Virginia – Dept. of Environmental Quality (DEQ) administers the requirements of the federal Clean Air Act, and enforces state laws and regulations to improve Virginia's air quality. The Department of Environmental Quality or DEQ is required to conduct air quality monitoring by both federal and state regulations. The air sampling program is a combined effort of the Air Quality Assessment Office or AQA, Air Monitoring, seven regional offices, the Fairfax County Air Pollution Control Bureau, and the Alexandria Health Department. The EPA has specific requirements for a minimum number of monitoring sites, called NAMS - National Air Monitoring Sites, and Virginia has augmented these with additional sites, called SLAMS - State & Local Air Monitoring Sites to provide additional air quality data for DEQ needs.

Data Management

MD Gap Analysis – MD DNR's goal is to map vegetation to the alliance level across the state. Partners include TNC and MD Wildlife and Heritage Program. Contact Paula Becker (pbecker@dnr.state.md.us), ecologist with the MD Heritage Program's Gap analysis. Maryland vegetation mapping has just been completed for the entire state. The vegetation maps follow NVCS standards and are FGDC compliant. They were developed using Landsat imagery at 30 m resolution. In addition they used soils data, DEM, National Wetland Inventory data, and aerial videography. These were combined and the spectral signatures analyzed for vegetation types. The resulting vegetation maps are at 2 ha minimal mapping unit. Given the resolution, riparian forests are not well represented. The Gap analysis has also been working on the Hexagon Wildlife Modeling Project. This is nearly complete and combines range information with habitat information to produce management data.

VA Gap analysis - Contact Scott Klopfer (540-231-7348). VA Gap is developed by Conservation Management Institute (www.Fwie.fw.vt.edu). They have 3 main focus areas including Vegetation Mapping, Species Distributions, and Stewardship information. Vegetation Mapping: They have extensive experience with vegetation mapping; they also did Fire Island with Beth Johnson of the Northeast Region NPS. The VA maps are completed at 30-m resolution similar to MD. The classification is independent but has been cross-walked to NVCS. They can develop more precise vegetation maps for smaller parks such as Manassas. (Shenandoah Vegetation Mapping does it though Leetown Science Center, WV; call Dave Morton for information). DOQ are available through NEDP Economic Development Project which have 1 m resolution (1:40,000 photo sets). Available online http://gis.vedp.org/mrsid (they also Landsat 7 imagery). Problem is that some photos are older (e.g. Manassas was from 1994 and new photos would need to be flown). One way to save money is to use videography which they used for VA Gap. Fly in fall with leaf color. For example, 20 miles of river costs about $6-7,000 through VA Tech. They have agreements with NPS already. They are employing this to work on refuges down to alliance. Species Distribution: Predicted distributions based on county data gathered by VDGIF. Heritage information is not tied into gap analysis. Report mainly on rare items. Incomplete listing. Stewardship Layer: Has done stewardship layer. Reviewed state and federal lands and their level of protection. Small NPS parks may not be included because of size.

Environmental Contaminants

Fish and Wildlife Service - Environmental Contaminants are monitored through Ecological Services. A variety of contaminants are of interest including pesticide use and oil spills. Mary Henry is the national contact for this program (703-358-2148). She can provide us a list of studies that are conducted every year. For more information: Contaminants.fws.gov. They maintain a database of contamination events. Maryland ES – Annapolis Field Office: 410-573-4501; Virginia ES – White Marsh: – 804-693-6690

Fire Effects Monitoring

National Park Service – Fire Effects: The Program goals are: Record basic information for all fires; Document immediate post-fire effects of prescribed burns; Share information between land managers; Follow trends in plant communities where fire research has been conducted, and identify future research needs. (See http://www.fire.nps.gov/fmh/ and http://www.nps.gov/fire/). The U.S. National Park Service has developed the Fire Monitoring Handbook, which contains a standardized protocol for monitoring and documenting prescribed fire behavior and effects. The handbook provides a system to document burning conditions and fire behavior, insure fires remain within certain conditions, verify completion of burn objectives, and follow long-term trends. This information can help managers in burn prescription refinement when objectives are not met or long-term undesirable trends occur, and to identify research needs. In support of the implementation of the handbook, data forms, software, and training courses have been developed. As the program begins its tenth year, nearly 50 parks with fire management programs have incorporated these protocols into their programs. Regional Coordinator is Tim Sexton (208) 387-5223. Don Boucher (FMO) 202-619-7039 and Alan Biller are working on fire management plans for the NCR parks.

Geological Monitoring

Geological Inventories are being conducted by Dr. Scott Southworth (703-648-4000) of USGS – Reston for all of the NCR parks.

Groundwater Quality – Groundwater is being monitored by the Maryland Geological Survey. Samples are collected from over 100 sites around the state. Sites are being sampled to document ambient ground-water quality, particularly in unconfined aquifers. These data provide a baseline against which future water-quality data can be compared. The data are also used to address other questions about water quality such as:

- What effect do aquifer minerals have on ground-water quality?
- What is the relation between land use and ground-water quality?
- What areas of the state are most prone to ground-water contamination?

Groundwater Samples are routinely analyzed for a core of constituents which includes major ions, nutrients (nitrogen and phosphorus compounds), trace elements, radionuclides, volatile organic compounds, and pesticides (table 1). Additional constituents are often analyzed to address specific groundwater quality issues.

Groundwater Depth – USGS monitors groundwater levels nationwide. Data is available sites in Maryland, Virginia, and West Virginia through: http://waterdata.usgs.gov/nwis/gw.

Landscape

Chesapeake Bay Program - The Chesapeake Bay Program is the unique regional partnership that's been directing and conducting the restoration of the Chesapeake Bay since the signing of the historic *1983 Chesapeake Bay Agreement*. The Chesapeake Bay Program partners include the states of Maryland, Pennsylvania and Virginia; the District of Columbia; the Chesapeake Bay Commission, a tri-state legislative body; the Environmental Protection Agency, representing the federal government; and participating advisory groups. Wink Hastings (410-267-5787) works on the Lands Task Force which is compiling an inventory of lands with significant resources (cultural and natural). They are starting with a GIS database including data layers such as forests, agriculture, and wetlands. Contacts: Bob Sewack coordinates Federal Committee - (410-267-9856); Bob Campbell is NPS liaison 410-267-5747).

MAIA (Mid-Atlantic Integrated Assessment; http://www.epa.gov/maia/). Contact Pat Bradley (bradley.patricia@epa.gov; 410-305-2744). **This multi-agency partnership created "An Ecological Assessment of the United States Mid-Atlantic Region: A Landscape Atlas".** The Atlas is an EPA report assessing relative ecological conditions across the mid-Atlantic region of the United States (encompassing Delaware, the District of Columbia, Maryland, Pennsylvania, Virginia, and West Virginia). The Atlas identifies patterns of land cover and land use across the region. It presents an ecological snapshot to help the reader visualize and understand the environmental conditions across the region, and how the pattern of conditions can be applied to community-based environmental decision making. The Atlas represents one of the first regional-scale ecological assessments of the Environmental Monitoring and Assessment Program (EMAP).

The report is based on data from satellite imagery and spatial databases on biophysical features such as soils, elevation, and human population patterns. It compares nine landscape indicators on a watershed-by-watershed basis for the lower 48 states (at a relatively coarse-scale resolution of 1 km), placing the mid-Atlantic region in the context of the rest of the country. Using finer-scale spatial resolution (e.g., 30-90 meters), the report then analyzes and interprets environmental conditions of the 125 watersheds in the mid-Atlantic region based on 33 landscape indicators. Results are presented relative to four general themes identified by stakeholders in the region: (1) people (potential human impacts), (2) water resources, (3) forests (forest habitat), and (4) landscape change. The Indicators include: a. Forest Health (Fragmentation, Forest Edge, Interior Forest Habitat compared to edge habitat). b. Watershed Indicators (Soil erosion, runoff processes). c. Riparian Indicators (Landcover along streams, Roads along streams).

Additional MAIA products include: 1. "An Ecological Assessment of the United States Mid-Atlantic Region: A Landscape Atlas". 2. Estuary Report. 3. NAWQA – groundwater streams and modeling pesticides. 4. Stream Report for MD. 5. Bird Project with Penn State (research) Tim O'Connel – used birds as indicator of ecological change. 6. EMAP streams – fish and benthic IBI. 7. Climate Change paper. 8. Forest Report. 9. MD Agriculture. 10. Lesson Plans for teachers. 11. Integrated Assessments. 12. Regional Vulnerability Assessments (RCVA). Program will identify vulnerable areas in

next 5 – 25 years. They will work with urban areas and smart growth. 13. REMAP - Biodiversity Project – T & E Species, Amphibian calling survey, bird community index, non-indigenous species. 14. Non-indigenous species – conference in 2000.

TNC – Ecoregional Planning Efforts. TNC has been developing ecoregional plans throughout the nation. The plans were designed to protect common species in addition to rare species and communities. Environmental processes such as fire are also considered. The National Capital Region passes through four ecoregional mapping units including: Chesapeake Bay Lowlands (Contact: Doug Samson – MD Chapter TNC), Central Appalachians (Completed; Contact Jim Thorne – PA Chapter TNC), Lower New England (Draft completed; Contact: NA), and Piedmont (Contact Judy Dunscomb - VA Chapter TNC). Priority sites have been identified in Maryland and Virginia.

Meteorological Data

Meteorological data are being collected by a several parks (CHOH, ROCR) although it is also available near most other parks, either on-site or from a nearby park or NOAA/NWS facility. For precipitation data see: http://www.noaa.gov/precipitation.html.

Restoration

Chesapeake Bay Program: Restoration activities are conducted by the Chesapeake Bay Program for submerged aquatic vegetation restoration. See Chesapeake Bay Program above for contacts.

DC Council of Governments (COG) has lead the development of the Anacostia Watershed Restoration Indicators and Targets for Period 2001-2010. The planning process set 6 restoration and conservation goals for the Anacostia Watershed and identified a number of indicators that require monitoring. The lead contact is John Galli at COG (202-962-3348). Brent Steury (Resource Manager at NACE) worked on the technical committee for this document. NPS responsibilities are limited to restoration work at NACE especially Fort Dupont. NPS has already reintroduced fish at NACE, implemented pool enhancements, storm surge flows, settlement pond, and riparian buffers. These efforts were part of a larger watershed restoration project that received extensive financial assistance from City of DC and EPA.

The Nature Conservancy (MD) conducts tree planting, hydrological restoration, acid mine reclamation, invasive species control.

Visitor Impacts

None of the parks in the NCR are monitoring visitor impacts. Numbers of visitors, however, are tracked in all parks through visitor center counts, interpretation programs, and road counts. The NPS is generally not monitoring visitor impacts in developed sites such as those found in NCR because they are already developed. The NPS has traditionally placed more emphasis on monitoring and restoration in wild areas. Some work has been done locally at Shenandoah and along the Appalachian Trail through the Harpers Ferry Office. Contact Dr. Jeff Marion (USGS; formerly with Mid-Atlantic Region of NPS; jmarion@vt.edu 540-231-6603). Dr. Marion is working on a "Vital Signs Development Study" at Cape Cod. He is measuring trails and assessing their conditions to see how they change and how wildlife responds.

Water Quality

Arlington County Environmental Services – The county has a National Pollutant Discharge Elimination System permit (NPDES) that requires the county to monitor storm water runoff at representative outfalls. Over next decade, EPAs Total Maximum Daily Load (TMDL) will also affect Arlington County. Under this regulation, each state must set the maximum pollutant load that can be delivered to impaired waterbodies so that they can meet water quality standards.

Arlington Dept of the Environment - The agency focuses on monitoring water quality using volunteers. Work is already being coordinated with George Washington Memorial Parkway which is using the same protocols and exchanging data. Protocols are the same as used by Audubon Naturalist Society (ANS; see below). Contact: Aileen Winquist (also Jay Papacasm at Dept. of Env. Quality: 703-228-3613 and Scott Diabler 703-228-3403 in charge of trout program). In addition to the volunteer effort, Arlington County, does water quality monitoring at 4-mile run because of trout releases. They have, however, only collected data in 2001 and there is not enough information to analyze trends.

Audubon Naturalist Society (ANS) - is coordinating a regional water quality monitoring program using volunteers. Methods are standardized. Sampling focuses on macroinvertebrates. Contact is Cliff Fairweather (301- 652-9188). For more information see: www.audubonnaturalist.org.

DOD - USAG Fort Belvoir. Contact: Dorothy Keough (703 - 806-0049; keoughd@belvoir.army.mil. Water quality, fish (including anadromous fish), and benthic surveys done of Dogue Creek, Accotink Creek, Mason Run and two unnamed streams on Fort Belvoir done from 1999 through 2001. Survey protocol developed and executed by EA Science, Engineering and Technology. Dr. Kelso and Dr. Jones performed aquatic surveys of Accotink Creek, Pohick Creek and Dogue Creek from 1995 – 1996. In addition, George Mason University, Contact: Dr. Donald Kelso (703-993-1061) and Dr. Chris Jones. Under contract to Fairfax County, since 1984 has been

monitoring water quality, plankton, benthos and fish of Pohick Creek, Gunston Cove, Accotink Creek and Bay, Dogue Creek and Potomac River. Also, since 2000 (?) George Mason University has been monitoring aquatic conditions in a dredge disposal site in the Potomac River, just off Fort Belvoir. Work is being performed for Baltimore Corps of Engineers (Mr. Bob Blama (410- 962-6068.

Environmental Monitoring And Assessment Program (EMAP) – Surface Waters – – Set up to develop scientific tools necessary for monitoring status and trends in the biological integrity of surface waters and the relative magnitude of critical stressors. There are 638 sites in the Mid-Atlantic. Water quality data available online http://www.epa.gov/emap/html/dataI/surfwatr/data/index.html on benthic, fish, fish tissue and chemistry.

Fairfax County - Fairfax County is monitoring water quality. They are looking mainly at stream health using macroinvertebrates. The benchmark stream was identified in Prince William Forest Park. The county has developed an IBI. A report was issued last January: www.co.fairfax.va.us (look for stream protection strategy). In addition to the water monitoring there are a variety of other efforts in the county including volunteer efforts by ANS (see above) and the County Health Dept. The county's adopt-a-stream coordinator is Ed Pippin (703-246-2341 or 703-246-2205 for Dept. of Env. Health).

The County also put together a report recently: www.co.fairfax.va.us/service/hd/strannualrpt.htm. The report provides information on fecal coliforms and nutrients. For more information contact Fred Rose Storm Water Management Plan 703-324-5800.

Izaak Walton League of America - Save Our Streams - Since 1969, the Save Our Streams (SOS) Program of the Izaak Walton League of America (IWLA) has been a leader in citizen education in water quality monitoring, watershed restoration, and the importance of wetland protection. The mission of the SOS Program is to help communities achieve sustainability of their water resources through education and technical support; and to inspire stewardship and conservation of local watersheds. In 1993, SOS launched the Stream Doctor™ Project. Stream Doctor helps people diagnose stream problems, write a "prescription" for recovery, and initiate long-term "wellness care" for their stream. In 1996, SOS staff launched the Wetlands Conservation and Sustainability Initiative. The primary goal of the initiative is to teach citizens wetland ecology, functions and values, and to provide the necessary tools for participation in wetlands conservation activities, such as monitoring.

Maryland Biological Stream Survey: See MBSS under "Fish" above.

Montgomery County – Dept. of Environmental Quality monitors fish and aquatic macro-invertebrate communities as indicators of water quality. Sampling sites are located throughout the county including Little Monocacy, Rock Creek, Cabin John Creek, Broad Run, Dry Seneca Creek, Muddy Branch, Watts Branch, and more.

National Park Service - Water Resources Division (WRD): Have made recommendation of core variables that should be monitored at each park. Draft available at: http://www.nature.nps.gov/im/monitor/handbook.htm. Core variables include: Temperature, specific conductivity, pH, DO. Optional variables include flow (gauging station), discharge, biomonitoring (following EPA rapid bioassay of macroinvertebrates protocol), and alkalinity (acid neutralizing capacity).

Potomac Conservancy - They are starting a new River Monitoring Program: Watershed Watcher. Contact Matt Berres: 703-276-2777.

National Water-Quality Assessment (NAWQA) Program is designed to describe the status and trends in the quality of the Nation's ground- and surface-water resources and to provide a sound understanding of the natural and human factors that affect the quality of these resources. This information is gathered in every state by USGS scientists to minimize the loss of life and property from natural disasters, contribute to the sound conservation and the economic and physical development of the nation's natural resources, and enhance the quality of life by monitoring water, biological, energy, and mineral resources. As part of the program, investigations will be conducted in 59 areas called **"study units."** These investigations throughout the Nation will provide a framework for national and regional water-quality assessment. Regional and **national synthesis** of information from study units will consist of comparative studies of specific water-quality issues using nationally consistent information.

The U.S. Geological Survey (USGS) began its NAWQA (National Water Quality Assessment) program in 1991, systematically collecting chemical, biological, and physical water quality data from study units (basins) across the nation. The **Potomac** study units first high-intensity phase began in 1991 and ended in 1995, one of nineteen across the country. By 1997, the NAWQA program consisted of 60 study units investigating major river basins and aquifer systems that will account for about one-half of the Nation's land area and two-thirds of the Nation's water use and population. Currently, the Potomac study unit is in the low-intensity phase of the program.

Virginia – Dept. of Environmental Quality is the lead agency for water quality monitoring. Currently monitors over 1,100 stations at least once a year. Site list available at: http://www.deq.state.va.us:4100/webapp/wqm.homepage. They produce the "Virginia Water Quality Assessment Report (305(b) Report" once every 2 years. They also submit "Total Maximum Daily Load Report (303(d) Report" every 4 years. The TMDL establishes the amount of pollutants a body of water can accept while still meeting VA water quality standards. State standards are set by Clean Water Act include minimum physical, chemical, and biological parameters. States can develop standards that are more stringent than federal guidelines and usually start with citizen initiatives. There are currently no standards for sediments even though it is a major problem. There is currently a draft for nutrients (May 2000). Virginia promotes volunteer monitoring. DEQ has a full-time citizen monitoring coordinator. It seems that the state is putting a lot of responsibility on these citizen volunteers. In Northern Virginia, there are several monitoring sites including: Difficult Run, Four Mile Run, Hunting Creek (GWMP) and

Bull Run (MANA). There may be others. See "State of our Rivers Report for the Commonwealth of Virginia – January 2001".

Washington DC: Water quality Division: Contact: Peter May (202-535-2190; peter.may@dc.gov; www.dchealth.com/eha/wqd/welcome.htm). The Program was established under the authorities of the D.C. Water Pollution Control Act and the Federal Clean Water Act (CWA). The program has three principal components: Water Quality Control – this component fulfills the function of policy planning as well as regulatory control. In addition, it conducts special studies on pollutant fate and transport to identify probable sources and impacts, river/stream sediment and water column quality not covered by ambient monitoring, wet weather nonpoint source runoff quantity and quality, discharge related facility inspections and tracks permit violations. Water Quality Monitoring - encompass waterbody assessment, collection of ambient water quality data, periodic fish tissue analysis for parameters of concern such as PCB, Chlordane and DDT, periodic submerged aquatic vegetation survey, and bioassessment of wetlands and river fringes. Environmental Laboratory - is charged with the analysis of samples for a variety of chemical parameters.

Other Regional I & M Programs

USFWS

Ecosystem Management: USFWS has adapted ecosystem management approach. The country is divided into 53 ecosystem units defined by USGS watersheds (http://offices.fws.gov/ecounits.html). The NCR corresponds with Chesapeake Bay/Susquehanna River Ecosystem. Past projects include Anchored Gillnet Migratory Bycatch Study in cooperation with DR/DC, Bog Turtle Habitat Restoration, Sturgeon Stock Assessment through Reward Program, Potomac River Water Quality Study, Regal Fritillary Butterfly Genetics Study, Endangered Bat Habitat Protection, and Outreach. Inventories and Monitoring: The FWS is also initiating a national I & M program. Contact John Morton of Blackwater NWR who is working on a FWS I & M committee (410-228-2692; john_m_morton@fws.gov). Their goal is to determine how information from its 570 refuges can be analyzed to evaluate the state of the refuges. The NE Region (5) is in the process of developing some regional I & M priorities and projects. Most likely, these will be superceded by national priorities once they are developed. There are already a number of national programs (not refuge programs but FWS programs) that could be adapted by the refuges. For example, there are CBC, BBS, MAPS, NAAMP (see above for their descriptions), etc.

Long-Term Ecological Research Site (LTER). A research program supported by the National Science Foundation for ecological studies and experiments. Established in 1980. There are now 21 LTER sites which include 2 urban ones (Baltimore and Phoenix). The Baltimore Ecosystems Study is part of the LTER and includes researchers from USGS, John Hopkins University, University of Maryland, USDA, etc. Contact: Stewart Picket (845-677-5343; cell 914-475-0843).

The Baltimore LTER seeks to integrate research on ecological, physical, social, and infrastructural components to understand the metro area as a comprehensive system. The goal is to measure the effects of people on ecosystem study units. Social structure and processes are crucial components of the working model of the metro area which is human dominated. Ecosystem processes including nitrogen and litter dynamics, vegetation dynamics, soil characteristics, and the role of exotic species are a core focus. Permanent plots have been established in grass covered areas to complement existing forested plots. The vegetation is being examined using the Forest Inventory Analysis (FIA) and a rigorous analysis of tree-covered patches. Intensive studies of riparian zones, including vegetation, soils, and heavy metals were initiated this year. The riparian studies complement our ongoing measurement of stream flow and water chemistry. Also looking at paleoecological studies that focus on the riparian zones and sediments in the Baltimore Harbor, where cores have been extracted to measure pollen, seeds, and heavy metals. This project has a strong environmental education component. The Central Questions of the Baltimore Ecosystem Study: 1. "What are the fluxes of energy and matter in urban ecosystems, and how do they change over the long term?" 2. "How does the spatial structure of ecological, physical, and socio-economic factors in the metropolis affect ecosystem function?" 3. "How can urban residents develop and use an understanding of the metropolis as an ecological system to improve the quality of their environment and their daily lives?"

Fairfax County – The county has 32,000 acres of undeveloped lands of which 19,000 are in parks. The county is going through a Natural Resource Planning process that will identify additional monitoring needs. Contacts include: County Environmental Coordinator – Cambiz Agazi – 703-324-1788; County Planner – County Executive Office – Mary Ashton – 703-324-3408. Planning Coordinator - Noel Caplan (Env. Coordinator; Noel.kaplan@co.fairfax.va.us; 703-324-1369) is charged with coordinating this effort. In addition to planning there have been a few inventory projects by George Mason University about 10 years ago. Todd Bolton (with Park Authority 703-324-8675) is developing GIS maps based on the inventories. The County parks are also involved in some inventories but typically non-systematic surveys. Gary Orsen from Fairfax County Park Authority noted that Huntley Meadows has an extensive monitoring program covering plants, birds, butterflies, herps, dragonflies, etc.